An Essay
on
the effects of cold.
for the degree of
Doctor of Medicine
in the
University of Pennsylvania.
by
Clark D. Parks
of Georgia.
January. 1829.

The effects of Cold.

The passage of Caloric into a body produces heat, & its passage out of a body Cold. Heat & Cold are then mere sensations; neither of them having in reality an existence as separate & distinct agents. When speaking of the production of heat, we recognise the reception of a quantity of Caloric into a body; & in the same manner when a body is undergoing the cooling process, we know that it is parting with a portion of its Caloric: & the perception by the animal system of these two processes gives rise to the expression, heat & Cold. When, therefore, we say that a body has become Cold, we are understood to mean that it is deprived of a part of its Caloric. And since long usage has removed the objection to the inaccuracy of the expression, & has made it common & familiar to all, it will be retained while I propose to make a few observations on Cold as a salutary & morbid agent, the phenomena that take place from its application both local & general, & in a moderate & intense degree.

The power of generating heat, & preserving an uniformity of temperature, has been considered the grand characteristic of animal life. The animal body is endowed with this power of evolving heat to a considerable extent, much above the ordinary temperature of the atmosphere. It is even increased by the necessity occasioned by external cold, & diminishes with the increase of the atmospherical warmth, so that during a state of health, the temperature of the animal is pretty uniformly the same, notwithstanding the extreme variations of the external atmosphere. Or in other words this evolution of heat is regulated according to the demand made from without. Such, indeed, is this power, that an atmosphere of the same temperature with the animal is found extremely incommoding to the feelings. From observation & experiment the temperature of man has been fixed at 98 degrees (Fah.) & of course physically speaking, every degree below that would be cold; but as regards his sensations, the temperature of the surrounding medium does not become cool until reduced below 60 degrees; which is the most grateful & invigorating, & appears to abstract the heat of the body, in

the name,

Trustees and

to convert

Attorney of

the Substitute

Oldham

substituted

to direct pro

subject to a

N.B. Dated

tee in a

by Interest

or a year and

Section 6 by

Advancements

Trust shall pro

Trusts the

investment pro

Trust the

the same proportion in which it is generated, without any extraordinary exertion of the system; & therefore neither contributes to exhaust its powers, nor to excite uneasy sensations. Thus the constitution of man is widely adapted to the medium temperature of the habitable globe.

Closely connected with this power of generating heat, is another important attribute of vitality, by which the living system is enabled to resist great degrees of heat, supporting its own temperature when exposed to external warmth far above any known in nature. Dubamel & Duhillet of France exposed themselves for nearly five minutes in a room heated to a temperature equal to 290 degrees (Fah.) They likewise observed that the maid servant of a baker could remain, for a quarter of an hour, in an oven heated to 296 degrees, where mutton chops were roasting & beef-steaks were broiling. In these experiments the temperature of the body was not raised more than 3 or 4 degrees. They were attended with no injury, & clearly demonstrate the resistance which the living system is capable of making against great degrees of heat. The more or less intensenes with which the mind is engaged, modifies in a striking manner the

effects of heat. It has been remarked by a distinguished professor of our country, that he knew a zealous chemist of this city, during the hottest summer days & in the confined atmosphere of a heated laboratory, to pursue his inquiries uninterruptedly, extolling the pleasantness of his room, his agreeable situation and employ.

Great as is this power of resistance to heat, the immunity with which the living system can resist great degrees of cold is no less remarkable. If a definition of life was required, it might best be founded on the facility possessed by the living body of enduring the same heat in various degrees of temperature of the same medium, and, indeed, in media of very different density & texture. (Currie) The sensations of different men vary according to the power, which their respective constitutions have, of enduring heat. This power depends much upon the original vigour, of the system, it is also greatly influenced by habit. In this climate we suffer very little inconvenience from a temperature 5, 5 or 10 degrees below zero. And in Russia, as Mr. Tooke remarks, the drivers & their horses feel little or no inconvenience

in pursuing their employment during extreme cold, when the thermometer is from 20 to 30 degrees below the zero of Reaumur, & the women will stand rinsing their linen through holes in the ice, for 5 or 6 hours together, often bare-footed, with their hands dipping in the water all the time, & their draggled petticoats stiff with ice.

The greatest degree of cold actually known to have been supported by the human body, was that observed by Gmelin in 1735, at Jenisseisk, in 58° lat., 110 long. The mercury in the thermometer fell down to 120° below zero (Reaumur.) Pallas in his travels through Siberia in 1772, remarked at Krasnojarsk, 55° lat., 110 long., that the thermometer fell to 50 degrees below zero; & even lower for the mercury in the bulb was congealed, & in the open air was frozen & became partly malleable. (Reeve.)

At Hudson's Bay, Capt. Middleton assures us, that the lakes 10 to 12 feet deep were frozen to the bottom, & even in heated rooms wine & spirits could not be kept in a fluid state. During the long winter days the English there hung up in their rooms twenty four pound balls heated red hot; & although they

kept an immense fire, yet soon after it was out, the walls of the room & the beds were covered with ice three inches thick. Great as this degree of cold is, yet man is capable of enduring it, provided he keeps using exercise: he is able to resist by exerting his powers, what animals are compelled to submit to, by resigning themselves up to complete inactivity. (Rees on Longitude)

Some Dutchmen passed a winter, at Nova Zembla, under 75° north lat., when the cold was so intense as to freeze their wine, although their hut was covered in & heated. Some perished: but those who took exercise were able to resist a degree of cold, that even the white bears, a native of those regions, could not support, & none but the white fox (Canis lagopus) was able to live there with man.

There are many instances, where persons have remained buried under the snow for 5, 6 and 8 days without yielding to the powerful influence of the cold in such a situation. Of a crew of 14 men, shipwrecked & immersed in the sea of 33° Fah. during 23 hours, three resisted the action of the cold & recovered. (Currie)

Dr. Currie, in his experiments of sudden immersion in the salt water bath of 44 degrees, generally found the heat reduced &

to 12 degrees at first, but after continuing the bath sometime the loss of temperature was commonly 3 to 4 degrees. The pulse was diminished in frequency 4 or 5 strokes in the minute. A sensation of coldness & faintness at the stomach was attended with a rapid reduction of the heat, the motion of the heart becoming feeble & languid, evincing some peculiar connexion of the stomach with the process of animal heat. Considering the rapidity with which a dead body would have cooled, immersed in water of 40 degrees, we may duly estimate the power in the living animal body of evolving heat.

A great many circumstances promote or diminish this resistance, which the system makes to the impression of cold. The suddenness or abruptness of the application has a powerful agency in lessening the temperature of the body. Sir. Currie proved this on his own person. Preparing two baths, one of 35°, the other of 95°, being his own heat, he descended slowly, bathing on a loose flannel drap, into the cold bath & remained in it two minutes: he then got slowly into the hot bath & remained in that also two minutes, & repeated the movement. But during the whole of these changes the thermometer never varied from 96 degrees. (P. 155.)

The state of the mind has considerable influence in the result of applying cold to the body. Fear increases the sedative effects of cold in a remarkable degree. Dr. Currie proposed to try the effects of 4 or 5 minutes immersion in the cold bath of 40 degrees on a man of pale complexion & feeble frame. The fear of so great a degree of cold reduced his heat 23 degrees. Upon the first plunge his temperature sunk 5½ degrees lower than it had in a former experiment. & at the end of 30 minutes it was 9 degrees lower, (In the first experiment the bath was 42°.) When the mind is intently occupied in the pursuit of any object, it will in a certain degree deaden, or prevent the sensation of cold. The astronomer intent upon the objects of his sublime science, it is said, neither feels, nor is injured by the damps or chillness of the night; & in some species of madness, when the ideas of the imagination are too vivid to admit the impressions of sense, cold is resisted to an extraordinary degree. Dr. Currie goes on to say, "I have seen a young woman, once, of the greatest delicacy of frame, struck with madness, lie all night on a cold floor, with hardly the covering that decency requires, when

the water was frozen on the table by her, & the milk she was to face on was a mass of ice.' (P. 154.)

The condition of the body varies considerably the effects of cold. In experiments made upon persons differing as regards health, temperament, vigour of constitution &c. the thermometer was found to be variously affected. Exposure of a healthy person to moderate cold strengthens all the functions of the body, whereas a person of a weakly constitution is depressed, chilled, & thrown into a fever under similar circumstances.

The above facts & observations clearly prove that the living body can bear great degrees of cold with impunity, but in what manner, or what powers of the system are brought into action cannot be clearly defined, as they are passive, manifesting no remarkable or striking phenomena.

But when the cold has not been continued too long, or so intensely as to destroy life, a suspension of phenomena arises, which are termed <u>reaction</u>. It is a law of the animal system to react, when exposed to the deleterious influence of depressing agents; its powers appear to be collected, strengthened, & excited to more vigorous

exertion. The nervous & vascular system have increased power, & in fact every part of the body displays greater activity. This lively return of sensibility, vascular action & temperature is seen after the system has been depressed by severe blows, by gunshot wounds, fears, important surgical operations, the cold stage of an intermittent, & by no agent is it more clearly evinced than the sedative operation of cold. Many examples and cases might be brought forward to prove this reaction, but its universal acknowledgement supersedes the necessity.

Living bodies, therefore, generate heat, resist high degrees of heat, & also great degrees of cold, & under certain circumstances, are capable of reacting with increased energy from a temporary depression. Such is the body upon which we are to consider the effects of cold.

And, first, we would consider the phenomena of a diminished temperature upon a part of the body, as noticed by the most approved & experienced writers on this subject. When a part as the hand, foot, nose, ear &c, is exposed to a sufficient degree of cold, the circulation in the capillary vessels is retarded, the skin, becoming of

a dark red, or assuming a mottled colour, soon grows pale, rough, & contracting around the small glands & roots of the hairs, exhibits the cutis anserina appearance: this contraction exists not only in the skin, but likewise extends to the collular membrane, the bulk of the internal part is diminished, so that rings fall off the fingers, & shoes from the feet, which were tight when the parts were warm. The natural temperature of the part is diminished; the irritability & sensibility are impaired. The alteration of the vital properties commences with painful formication; succeeding to this disagreeable sensation is a local numbness, an incapability of accurate discrimination of touch, upon taking hold of a body the sense of feeling is blunted, & finally disappears altogether. In all such cases the sensation of cold speedily subsides, & even though ice be lying on the part affected. (Currie) A part thus circumstanced is said to be in a state of asphyxia. All appearance of vitality may be gone, before the part is frozen; & perhaps actual congelation never takes place without a complete extinction of all living principle. Yet after parts have been entirely frozen, they may be recovered. If they cannot be frozen until the living

principle
Stonehenge
with the ca
Tides, and the
of Astronomy
Orbit the
below the
not, on
of its a
may be,
given pa
Results of
but, they
not the
but simpl
not accom
Instruments
not a lecture
may be

principle becomes extinct, it must be evident, that within themselves they never could recover their vital properties, even with the aid of all the remedies commonly employed in such cases, as heat, stimulide. They must, therefore, accept a portion of vitality from living parts with which they are continuous: Or if the conceiving of such acceptation be difficult, we must allow that life is suspended & remains latent in the frozen part, which has an inherent power within itself, of regaining its activity upon the application of caloric. However this may be, it is certain from the experiments of Mr. Hunter, that frozen parts may be recovered. He froze the ears of rabbits, & the combs of cocks, until the parts were so stiff & hard, that when cut, they flew from the blades of the weapon like a chip, without the least degree of pain or the slightest flow of blood. Violent inflammation followed the thawing of them, but was not accompanied with any rend or sloughing. These experiments confirm the fact, that when a part is frozen without a lesion of structure or impairment of organization, it may be restored to life by the contrary application of caloric.

How long parts may remain in this condition & how much the risk of destroying vitality will be enhanced, appears not to have been accurately determined by observation. Though many cases of recovery are on record, yet such restoration is considered by Dr. Thomson to be impossible. So long as a part is exposed to this degree of cold, all phenomena of life will be suspended; but upon the application of caloric a reaction takes place: it is announced by lively smart pain & redness of the skin. On the return of sensibility the blood flows into the dilating vessels, & occasions swelling. An insupportable formication & itching arises in the whole part; the pain is excessive & darting; an ardent inflammatory action is established, attended with sharp & biting heat. When the skin, at the height of reaction, exhibits the appearance of equal redness, it is less indicative of gangrene than when it assumes a livid or violet marble colour. The epidermis, rising in different places, forms brown or blackish vesicles, filled with serous, yellowish & bloody or ichorous fluid. These increase the disagreeable & obtuse sensation that is experienced in such cases. The gangrenous inflammation

extends to the skin & beyond it involving deeper seated parts. In more violent cases the cessation of sensibility & organic action is complete, there is a feeling of weight in the part; an easy separation of the cuticle discloses a livid marble colour of the cutis, there is a flaccidity of the muscular fibre, an insensibility to stimulants, a putrid exhalation succeeds — the part is in a state of complete sphacelus.

Thus it appears that all the phenomena, produced by the local application of cold, manifest primarily a sedation & secondarily an excitement of the part, the symptoms of increased strength & excessive inflammation never arising until the vital powers react. The celebrated Richter of Germany was the first to notice the fact, that chilblains were never the direct consequence of cold, even the most intense. The same thing has been maintained by Thomson, & most abundantly proved by Larrey. He considers cold as the predisposing cause of inflammation, & in proof of the fact mentions, that on his voyage to Newfoundland, touching at Belle-Isle, they took on board 21 shipwrecked sailors:

they were pale, disfigured, benumbed with cold, & suffering from hunger & thirst. Many had their fingers & toes frozen. Under the best treatment a majority of them had local gangrene. Yet while exposed to the cold atmosphere none of them had inflammations. During the campaign in Holland a great number of soldiers had their feet frostbitten, but the gangrene did not appear until the thaw commenced, although they had been exposed to snow & heaps of ice. During the three or four days of extreme cold that preceded the battle of Eylau, while the mercury was as low as 10 to 15 degrees below zero (Reaumur) & until the second day after battle, not a single soldier complained of being frostbitten, although they passed the day & a greater part of the nights from the 5th to the 9th of July, on the snow & under the most severe frosts. The imperial guards, in particular, remained on duty in the snow, without much exercise, for more than 24 hours, & none of them complained of frostbitten feet. The temperature was suddenly raised 15 to 20 degrees (Reaum) & immediately a number of soldiers complained of acute pains in the feet, torpor, heavings, and a

disagreeable pricking in the extremities, which were slightly swelled & of a dark red colour. In some there was a slight redness, in others the toes had lost their sensibility, heat & motion, and were black & in a manner dried.

These facts are doubly important, clearly showing that chilblains & inflammations are produced indirectly, & never until reaction takes place, & likewise pointing out the danger of the incautious application of heat after severe exposure to cold. The knowledge of this last circumstance has formed the correct method of treatment to be pursued in these cases. It is thus that well known facts establish principles to be relied on in the management of diseases. Parts in a state of asphyxia from cold are to be treated according to the degree of cold to which they may have been exposed. When there is but a slight numbness, a gentle & graduated heat, or moderate friction with flannel, may be employed. But when there exists complete stupor, the method consists in slowly exciting reaction, & gently recalling the vital properties. In order to thaw a frozen part, it should be rubbed with snow, until sensibility &

motion return; frictions may then be made with brandy. Internal stimulants are sometimes necessary. When the means employed have been too powerful, it is proper to resort to cold. The part may be immersed in water of a temperature approaching the freezing point. This should be continued until the swelling, pain &c. begin to diminish; then frictions with brandy — the warmth being gradually restored, with moderate reaction, & finally perspiration following, indicate the successful termination of the case.

Partial Asphyxia from cold having been examined, the consequences of a diminished temperature upon the general system will next engage our attention, & first of its moderate application. When a person possessing the advantages of health, youth, & good constitution, is exposed to moderate cold, all the vital powers are roused & excited to more vigorous life. The action of the heart & arteries is increased, the nervous system is awakened, the skin receives an agreeable glow, the countenance wears a fresher bloom, the blood circulates with facility, the appetite is sharpened, the thorax dilates & breathing is performed with ecstacy, the

functions of all the organs are carried on with ease, & a degree of agility & vivacity is acquired hitherto unknown; a lively consciousness of existence seems to be felt throughout the whole system.

Here then we have a system full of life & activity, with every function increased & invigorated as under the influence of a powerful stimulus: hence we hear of the stimulant & tonic powers of Ether upon the human body.

But Ether likewise produces a true sedation of all the organic & animal functions. An abstraction of caloric, a diminution of the force of arterial action, of irritability & sensibility, are consequences of exposure to a diminished temperature acknowledged by all. These opposite effects of the same agent have induced many physiologists to consider Ether as sometimes stimulant & sometimes sedative; an explanation entirely inconsistent with our notion of the identity & stability of the laws which govern in physiology, as well as other branches of science. The idea that heat is a stimulus, & Ether, being the abstraction of heat, must be a sedative, is not the less true although laughed at & ridiculed by men distinguished alike for talent & ingenuousness. As of yellow

-low fever, that it is always contagious or non-contagious, so likewise it may be said of cold, that it is uniformly stimulant, or uniformly sedative. That abstraction of caloric can now increase, now diminish the vital powers, is contrary to every thing we have been taught to believe of the nature of cause & effect, & indeed can only be perpetuated by logical illusions. That we may profit by a more accurate knowledge of the laws of the animal system, a nicer discrimination between cause & effect, & likewise a more extended view of the subject, let us see if these discrepancies of opinion cannot be reconciled upon "true scientific principles: & that this may be effected in the true spirit of the Baconian or inductive philosophy"? let us enquire more particularly into the phenomena, which result from a diminished temperature.

Man, exposed to rigorous & immoderate cold, resists as long as the strength & vigour of his system will permit; but the power of nature has its limits, & the moment arrives when the vital principle becomes weakened, exhausted, & forced to abandon that body, which it has clung to so firmly under every disadvantage, to the increasing sedative power of cold. At first the circulation

becomes slower & weaker in the more exposed parts, as the hands feet, &c. the skin is of a dark red, contracted, & finally grows pale, the bulk of every external part is diminished. the respiration, at first interrupted, is slow & uneasy with sobbing, the pulse becomes small, quick, hard, & varying as to frequency. The sensibility of the nervous system is blunted, the hands & feet grow cold & numb, & are speedily insensible, the central heat is diminished, the stiff muscles contract irregularly, the body bends and shrinks, occasionally a feeling of weight & general numbness retards motion, the knees grow weak & unable to support the body, the sense of taste is impaired or lost, with difficulty of speech, the eyesight is obstructed; sometimes lassitude invites to repose, & an irresistible propensity to sleep is experienced, the subject entreats to be permitted to sleep, & expresses no other wish than to lie down & die, he slumbers, the brain is stupefied, the pupils dilated, & finally, a deep & mortal coma is inevitable unless fortunate succour arrive. 'No to that man who was overcome by sleep, in a few minutes he became completely frozen & remained dead on the spot he first fell upon'. (Larrey.)

Exam

Institutes,

Statutes, ed

Part matter o

in whole

to the reason

finally in

law on co

tion is Ex

indebtedness

sion of

minerals

among the

indebtedness

formation

tioned being

Dispute,

place co

Closed mort

That cold operates thus directly in producing languor, lassitude, faintness, weakness of the voluntary powers, torpor & death, is confirmed by numerous examples, mentioned by different authors. In an intense degree, it slowly yet certainly affects the whole nervous system; in consequence of which the irritability of the heart, & of every other muscular part, gradually fails; & finally life departs with a simultaneous cessation of every function on which its continuance depends. But the animal system is capable of retaining life under the appearance of death, sensibility & voluntary motion being lost, with apparent suspension of those functions, most essential to the preservation of the animal economy —; these are the phenomena which accompany the torpid state, & they constitute one of the most singular problems in the whole range of natural philosophy. Here the operation of cold is truly sedative, all the organic & animal functions being dispersed, or completely inactive. It is a matter in dispute, whether congelation of the animal fluids can take place without an entire extinction of life. The fact that blood does not loose its coagulating property by being frozen, &

that tube
in the chan
being fo
that anim
to the flow
of hatch a
At
low the
disparage
chance,
trouble, a
to bait
the sheen
Bon
American
tube, wh
the mouth
not a
are still

that cold blooded animals, as the leech, have been locked up in ice during the winter, recovering perfectly as the heat of spring gradually melted the ice, would seem to go far to prove, that animal life may lie dormant under actual congelation of the fluids: though we can scarcely imagine the possibility of such a state of things, especially in man.

A true sedation of the animal is seen in those cases, where the continued operation of cold has produced death, no disorganization having taken place. In the mountains of Switzerland, men have been lost in snow, & when found several months after they had disappeared, their bodies did not show the least signs of putridity, the cold having prevented any sensible decomposition. (Recte in torpidity.)

Bomare assures us, that there are still found in South America a considerable number of the conquerors of the new world, who, searching for mines of nickel, perished in snow on the mountains of Peru. Their warmth & ardour after gold did not defend them from the influence of cold, they perished & are still found in the various attitudes in which they

were frozen, constituting a sort of natural mummies. And it is said bodies have been preserved in Spitzbergen during 30 years. (Rees Cyclopaedia.)

From this view of the subject, it is evident that cold directly produces a powerful detraction of the vital strength of the body, commencing with pallor of the surface, gradually extending to & depressing the central powers of the system, enfeebling the action of the heart & diaphragm, attacking the brain producing stupor, insensibility & finally death; manifesting the most uniformly sedative operation.

How then shall we account for the agreeable glow of the skin, the florid bloom of the cheek, the lively expression of strength & vigour in the arterial & muscular system, the buoyant & active imagination, so often attendant upon exposure to a cool atmosphere?

These are phenomena of reaction, manifested when the constitution is vigorous, replete with health, & the cold moderate. From the directly depressing operation of cold, the external vascular & nervous energy is weakened, checked, & driven upon the central organs of the body, it concentrates & collects power, makes unusual & renewed exertion; the

centrifugal powers are awakened & restored to new & increased action, & we have the living system in the full blaze of life. Hence it is apparent, that cold is directly sedative, indirectly stimulant; & it is on this account, & from that law of the vital properties whereby they react when exposed to the influence of depressing agents, that it cures diseases, produces inflammations, & is altogether such a powerful adjuvant in the hands of the medical practitioner. We have only to recur to facts before stated to show that if the cold continues to operate, the reduction of the vital properties will progressively increase to the entire extinction of life unless the system is roused & revived by the aid of stimulants. In attempting to restore a person benumbed & frozen by cold, the greatest care should be taken in the application of caloric, or the use of stimulants; for if a person in this condition be brought into a warm atmosphere, chafed with warm flannels, stimulated with heated drinks, his feet & legs immersed in warm water, he may speedily revive, but will soon experience shooting pains, a violent reaction is produced, he is affected with dyspnoea, suffocation, & quickly finishes in a kind of universal apoplexy. Numerous are the instances of travellers, who, greatly suffering from cold, have died on immediate exposure to a large fire, whilst those who have taken opposite

means have been preserved. Lamey, on his voyage to N. America, observes, that touching at Belle-Isle, they found several epipematical sailors, who had been lying under the snow for many days during a period of intense cold. On the morning of their arrival the temperature changed, & two of them died suddenly, & the feet of several others fell into gangrene. The same author remarks, that about the end of the winter 1795, the army of the Eastern Pyrenees were exposed to very intense cold for 15 or 20 days, but no accident occurred, & no complaints were made to the medical officers. They suddenly passed to an elevated temperature, & during the first four hours of this change, some of the sentinels were found dead at their posts, & a great many soldiers had their feet frostbitten.

Pilher relates the case of a French peasant, who was lost on the mountains of the Pyrenees, he remained under the snow, benumbed with cold, for four days before he was discovered. He was carried into a warm atmosphere, external stimuli were freely resorted to, warm linen, dipped in aromatic liquors, was applied to his extremities, his feet speedily mortified & he soon died. (N. Cooper.)

Mr. Hunter says, if animals in a torpid state are exposed to the sun's rays, they will immediately show signs of increased life,

but quickly sunk under the chastisement & die. He likewise notices, that when intense cold has forced blackbirds to take shelter in outhouses, as many as were caught, from an ill judged compassion, exposed to a considerable degree of warmth very soon died.

But if further evidence on this subject was required, it is abundantly furnished by Larrey, an eye witness of all the disasters of the Russian campaign, when he exclaims, "No to the man benumbed with cold, whose animal functions were nearly exhausted & especially whose external sensibility was nearly destroyed, if he entered too suddenly into a warm room, or came too near the fire of a bivouac! The prominent parts, benumbed or frozen at a distance from the centre of the circulation, were seized with gangrene, which made its appearance at the very instant, & spread with such rapidity, that its advances were perceptible to the eye, or the individual was suddenly suffocated with a kind of turgescence, which appeared to affect the brain & lungs: he perished in asphyxia." Thus died the chief apothecary of the guards. He had arrived at Konow without any accident, but his strength was much reduced by cold & abstinence. An asylum was offered him in a warm apartment in the pharmacy of the hospital. He had scarcely been a few hours in this atmosphere, so new to him, when

his limbs, in which he had lost all feeling, became considerably swelled, & he soon afterwards expired, incapable of utering a single word. Many were seen to fall down stiff dead near the fires of the hirsmen.

Such are the fatal consequences of reaction from the accidental or injudicious use of Caloric & other stimuli, when the system is in a state of sedation from cold. Hence in the treatment of suspended animation, the leading indication is to raise the system, so as to ensure a safe reaction. The patient should be placed in a cool room & rubbed with snow or ice-water. In cases less violent, we may use dry heat, stimulating enema, warm applications to the epigastrium, ammonia to the nostrils, warm wine in small quantities. He may then be put to bed & given warm drinks. Under this treatment a perspiration breaks out, & all the functions are restored to order. Should, however, fever be induced, cold must be had recourse to. The patient should be carried to a cool room, given ice-water &c.

We have now seen, that the moderate application of cold to a body possessing health & strength produces reaction, which in the happiest manner increases the healthy phenomena performance of all the functions of both the organic & animal life: likewise that when the cold is more intense the external functions are weakened &

fatigued, if long continued, the internal & central powers of the system are attacked & depressed, & we have debility, irregular motions, stupor & death, showing no signs of reaction until the cold is removed & if this change be too sudden or the use of stimuli too free, a reaction ensues, which at once overwhelms the system with universal turgescence, a general congestion takes place & immediate death is the consequence.

As belonging to the organic system it remains to explain the manner in which cold induces internal inflammations. The reaction which follows the moderate application of cold in the vigorous constitution so productive of health & fine feeling, is very different when the equilibrium of excitement between the internal & external parts is not duly established, or when the subject of experiment is of feeble frame, or whose capillary circulation is weak & languid. Expose a person under such circumstances to a diminished temperature & what phenomena present themselves? A general feeling of uneasiness, an oppression about the thorax, accompanied with tension & fulness of the head, breast or abdomen, & some one of the viscera of these cavities expresses greater sensibility, pain is experienced, wandering pains are felt in the

limbs, great lassitude & muscular cramps, fever is induced. When once the system is under this febrile excitement, some one of the viscera weaker, or more irritable than the rest receives or invites an afflux of blood, its vital actions are increased, & then is a true inflammation established, hence pleurisy, catarrh &c. These symptoms are produced by a reaction of the system. Cold acting on the external cutaneous capillaries diminishes, this sedation is communicated to the internal capillaries, their nervous & muscular energy is diminished, contraction ensues, & the blood is collected in the large bloodvessels, especially by the venous trunks. An accumulation of excitability takes place, the conservative power of the system is roused, reaction follows, always beneficial in itself, but which from many circumstances may be prejudicial. If moderate the healthy functions are increased, if violent fever is induced, if the equilibrium of excitement is not maintained local inflammations are established. That the internal & external capillaries have a tendency to maintain this state of mutual relation with each other, is confirmed by the experiments of Dr. Currie, who found that when the external surface was exposed to cold, the thermometer under the tongue fell several degrees. It is well known

that the fo
applicat
ter by th
numbering
ne entire
with part
space of
application
ng the sec
ingers, a
ntain co
ral than
of influence
ment of e
application
on entire
observatio
internal
as observa

that the general action of Cold may be extended over the system by its application to a part. The use of Cold in hemorrhages is often separated by this maxim. Hemorrhagy from the lungs may be stopped by immersing the feet in Cold water, & perhaps this may be done still more certainly by a permanent application of Cold to the penis & scrotum, which part with this, heat more easily than any other portion of the surface of the body. In such cases a permanent or rather powerful application of Cold is requisite. (Parrie.) The effect of Cold to the feet during the menstrual period is well known. Hemorrhagy from the nose, kidneys, & uterus is frequently checked by the remedial agency of Cold. Maintaining any other view of its operation, what could be more improper than the use of Cold applications to the external surface in internal inflammations? If external sedation produced internal excitement & engorgement, no practice could be more hazardous than these applications to the head in phrenitis, or to the epigastrium in Gastro-enteritis. But the utility of this practice is fully proved by daily observation & experience, which could not be unless the activity of internal & external capillaries were simultaneously affected. So far as observation has shown, this constriction takes place in the Cold

stage of an intermittent, under the influence of fear, & other depressing passions. Moreover, when a person of delicate constitution is exposed to cold, whence arises the lividness of the lips & the bluenes of the nails? only the capillary vessels of the lungs are contracted & incapable of arterializing the blood. In such cases there is good reason to believe, that the blood is collected in the large vessels, especially the venous trunks, hence has been observed turgescence of the right side of the heart & venae cavae, & likewise rupture of the superior vena cava from inanition in the cold bath. (Dr. Hodge.)

A very important proof in point is furnished by Larrey in a very accidental manner, when he observes, that during the whole retreat of the French army from Moscow to Koenisburgh, notwithstanding the extreme cold, the great fatigue & privations of every kind, which they endured, the soldiers suffered from no internal malady: but that having reached the confines of Prussia, the army was permitted to rest for a few days, under warm shelters, & with an abundance of food. The greater part of the soldiers who had so happily escaped the dreadful influence of excessive cold & hunger, were seized, almost immediately, with a catarrhal fever, which very soon became epidemic

& contagious. On dissecting those who died, albuminous effusions were found on the surface of the brain, & the brain itself was softened & engorged with dark blood, as also its sinuses. The mucous membrane of the lungs & larynx was also marked with this black condition of the blood.

From what has been said there can be no doubt of the sedative operation of cold upon the organic functions of the system: but in the animal system pain & contraction are evidences of its stimulating power. Mr. Currie tells us, that the energies of life are roused into action, & the sedative influence of cold for a time counteracted through the powerful sensation, by which great & sudden change from a higher to a lower temperature are attended. This stimulus of sensation, though short in duration, is powerful in effect. In the tetanus of convulsion, when other agents are unperceived, the affusion of cold water on the naked body will often arouse the dormant sensibility, & introduce a new action throughout the nervous system. This stimulation depends upon the sensation by which the application of cold is attended. In cases of poisoning from opium, when both the animal & organic life are on the very verge of extinction, the sudden application of very cold water has the happiest effect in rousing the latent sensibilities & making them struggle as it were for respiration; the expansion of

which is the main cause of death in these cases: as it is shown by experiment, that if artificial respiration be established for a sufficient length of time for the deleterious influence of the poison to subside, no serious injury will be experienced. The effects of poison, taken into the stomach, upon respiration may be explained by the intimate connexion of nervous distribution to that organ & to the lungs. This explanation may perhaps apply to other cases of injurious agents acting upon the stomach. We know how suddenly death is produced by blows over the epigastric region, & also by large draughts of cold water taken into the stomach. The question arises, would the establishment of artificial respiration be efficacious in such cases?

Pain & contraction may both exist without any evident excitement of the organic actions. We have an example of pain without organic disturbance in tic doloureux. Here pain of the most intense & acute character, may exist for years without the slightest evidence of irritation. And on the other hand irritation & inflammation may take place without the least increase of sensibility. This is seen in internal inflm. which may exist for months, form extensive adhesions, go on to suppuration, & finally the pus is made to be discharged without its existence ever having been suspected. Because contraction takes place upon the application of cold, it does not

hence follow that it is a stimulus: this very contraction is evidence of the want of that stimulus necessary to healthy vital phenomena: it is the sudden abstraction of this fabulum vitae, the abrupt taking away of the normal supply of this vital supporter, heat, that throws the system into a state of perturbation, that leaves it unsupported & liable to all the irregularities of the abnormal condition. Bleed a patient frequently & to a great extent, & what do we perceive to take place? a state of system at once the most irritable & alive to external agents the most trifling: continue the sedative operation of venesection & convulsions will be the consequence. This great irritability & finally convulsions cannot here be the effect of excess of stimulation, unless the abstraction of stimuli be stimulating, & if so then is cold a stimulus, & venesection a stimulus.